

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
5 December 2002 (05.12.2002)

PCT

(10) International Publication Number  
**WO 02/097279 A1**

(51) International Patent Classification<sup>7</sup>: **F04D 29/66**,  
F16F 15/32

(21) International Application Number: **PCT/FI02/00460**

(22) International Filing Date: **29 May 2002 (29.05.2002)**

(25) Filing Language: **Finnish**

(26) Publication Language: **English**

(30) Priority Data:  
20011135 **31 May 2001 (31.05.2001)** **FI**

(71) Applicant (for all designated States except US): **FLÄKT VENTILATION AB [SE/SE]**; Birger Jarlsgatan 57 B, S-113 96 Stockholm (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HYVÄRINEN, Juhani [FI/FI]**; Iirislahdentie 1, FIN-02230 Espoo (FI). **WAINIO, Sami [FI/FI]**; Tullivuorentie 19 A 2, FIN-00700 Helsinki (FI). **IKONEN, Ilkka, T. [FI/FI]**; Perhostie 13 A 3, FIN-65230 Vaasa (FI).

(74) Agent: **HEINÄNEN, Oy**; Annankatu 31-33 C, FIN-00100 Helsinki (FI).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declaration under Rule 4.17:**

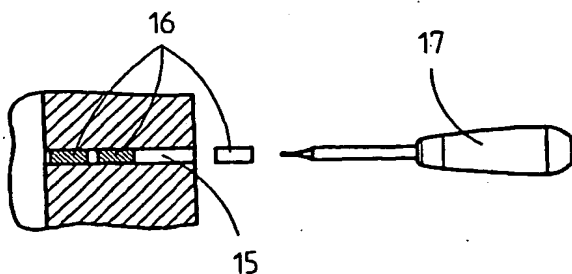
— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

**Published:**

— with international search report  
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **METHOD FOR BALANCING A FAN BLADE WHEEL**



(57) Abstract: Method for balancing a fan blade wheel (1) comprising a hub (11) and a rim (14) and blades (13) fitted between them, said blade wheel being provided with axial holes (15) arranged in the rim, which holes can be provided with weights (16) for balancing the blade wheel, in which the holes (15) are substantially longer than the weights (16) and in which the weights (16) can be set at desired depths in the holes so as to achieve the required balancing.

WO 02/097279 A1

## METHOD FOR BALANCING A FAN BLADE WHEEL

The present invention relates to a method as defined in the preamble of claim 1 for balancing a fan blade wheel.

5

Specification GB 2250783 discloses a radial fan blade wheel comprising two coaxial guide rings separate from each other in the axial direction, the blades being fitted between the rings. The electric motor of the fan is placed in the hub of the blade wheel. Axial pockets are provided on the circumference of each guide ring. In these pockets, weights can be placed to balance the blade wheel.

10

The balancing method disclosed in the above-described specification is relatively complicated, especially because it involves placing weights on two separate guide rings having different diameters. Moreover, achieving both axial and radial balancing is very difficult, and the balancing in the method according to said specification has to be performed manually because of the complex structure and pockets of the blade wheel.

15

The object of the invention is to eliminate the drawbacks of prior art and achieve a new type of method for balancing a fan blade wheel. In the method of the invention, the outer rim of the blade wheel is provided with holes going through the outer rim and weights are inserted/screwed into said holes to a desired depth according to the axial and radial balancing need.

20

The features characteristic of the method of the invention are presented in detail in the claims below.

25

The method of the invention is simple. In addition, it produces a good blade wheel balance in both axial and radial directions. Moreover, the method of the invention can be applied for fully automated balancing using an appropriate apparatus.

30

In the following, the invention will be described in detail by the aid of an example with reference to the attached drawings, wherein

35

Fig. 1 presents a blade wheel of an axial impeller, and

Fig. 2 illustrates blade wheel balancing according to the invention.

Fig. 1 presents an axial impeller according to the invention, designed for use e.g. in air conditioning systems and producing an axial air flow. The impeller comprises a housing and a plastic blade wheel 1 rotatably fitted on a shaft. At the center of the blade wheel 1 is a hub 11 with a hole 12 for a shaft, with blades 13 fitted around the hub, between the hub 11 and a cylindrical outer rim 14.

The blade wheel 1 rotated by an electric motor drive comprising a synchronous motor and a frequency converter controlling it, the frequency converter being connected to a 3-phase alternating-current network and producing a sinusoidal output voltage with controlled frequency variation. The stator of the motor may be fixed to the housing around the outer rim of the blade wheel 1, and the rotor may be integrated with the blade wheel so that it consists of permanent magnets (not shown) fitted on the circumference of the outer ring part.

For balancing of the blade wheel, the outer rim 14 is provided with holes 15 going through the outer rim at certain distances between them, these holes being used to hold balancing weights 16 (Fig. 2). The weights 16 are shorter than the length of the holes, so it is possible to set weights 16 to desired depths in the holes as required for axial and radial balancing.

The balancing can be carried out on a balancing machine having a rotary drive mechanism for rotating the blade wheel. The machine can be so controlled that it will stop the blade wheel at a position where an additional weight 16 is needed. An external cylinder 17 provided in the machine can push/screw the weight 16 to a correct depth. After this, the machine may carry out a test (rotating the blade wheel) to check the balancing.

The holes can be made in connection with the manufacture, implemented using e.g. an injection moulding method, of the blade wheel.

It is obvious to the person skilled in the art that different embodiments of the invention are not limited to the example described above, but that they may be varied within the scope of the following claims.

## CLAIMS

1. Method for balancing a fan blade wheel (1), said blade wheel (1) comprising a hub (11) and a rim (14) and blades (13) fitted between them, said blade wheel  
5 (1) being provided with axial holes (15) arranged in the rim, which holes can be provided with weights (16) for balancing the blade wheel,  
**characterized** in that  
the holes (15) are substantially longer than the weights (16), and that  
the weights (16) can be set at desired depths in the holes so as to achieve the  
10 required balancing.
2. Method according to claim 1, **characterized** in that the holes (15) extend through the rim.
- 15 3. Method according to claim 1, **characterized** in that the balancing is performed using a balancing machine having a rotary drive mechanism for rotating the blade wheel and an actuating device, such as an external cylinder (17), by means of which the weights can be pushed/screwed to the right depth.

20

1/1

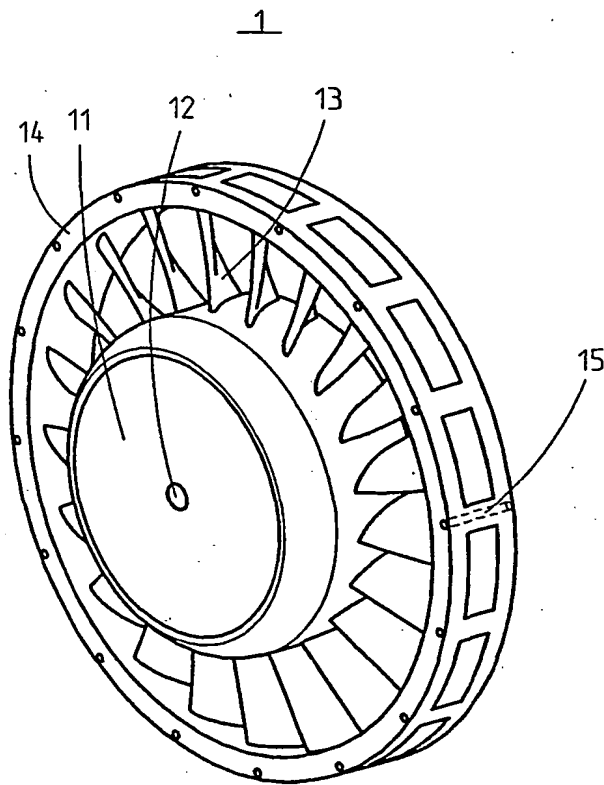


Fig.1

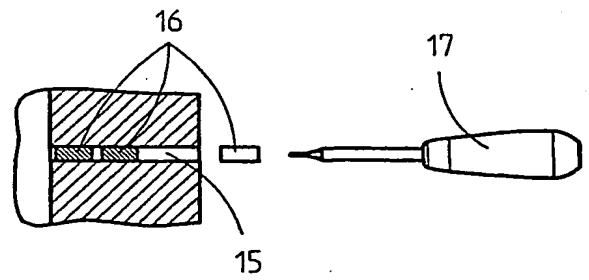


Fig.2

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00460

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F04D 29/66, F16F 15/32

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: F04D, F16F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2250783 A (PAPST-MOTOREN GMBH & CO KG), 17 June 1992 (17.06.92), figures 3-6, abstract  --	1-3
Y	Patent Abstracts of Japan, abstract of JP 5-141392 A (MATSUSHITA ELECTRIC IND CO LTD), 8 June 1993 (08.06.93), figures 1,2; abstract  --	1-3
Y	DE 19813718 A1 (MANNESMANN SACHS AG), 7 October 1999 (07.10.99), column 7, line 53 - column 8, line 22, figures 8-11  -- -----	1-3

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

23 Sept 2002

Date of mailing of the international search report

24 -09- 2002

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Lena Nilsson / MRO  
Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/09/02

International application No.

PCT/FI 02/00460

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
GB	2250783	A	17/06/92	DE	4136293 A	07/05/92
				US	5591008 A	07/01/97
-----						
DE	19813718	A1	07/10/99	NONE		
-----						

